

WHAT IS CLAIMED IS:

- 1                   1.       A robotic system comprising:  
2                   a master controller having an input device movable in a controller  
3 workspace;  
4                   a slave having an end effector, a linkage movably supporting the end  
5 effector, and at least one actuator operatively coupled to the end effector, the actuator  
6 moving the end effector in a workspace in response to slave actuator signals;  
7                   an imaging system including an image capture device with a field of view  
8 movable in the workspace and a linkage movably supporting the image capture device,  
9 the imaging system generating state variable signals indicating the field of view; and  
10                  a processor coupling the master controller to the slave arm, the processor  
11 generating slave actuator signals by mapping the input device in the controller workspace  
12 with the end effector in the surgical workspace according to a transformation, the  
13 processor changing the transformation in response to a tool change signal when the tool  
14 coupled to the holder is replaced by a selected alternative tool.
- 1                   2.       The surgical robotic system of claim 1, wherein the field of view of  
2 the imaging system is movable within the surgical workspace, the imaging system  
3 generating state variable signals indicating the field of view, and wherein the processor  
4 derives the transformation in response to the state variables of the imaging system.
- 1                   3.       The surgical robotic system of claim 1, wherein:  
2                   the master controller includes a linkage supporting the input device so that  
3 the input device can move in the controller workspace with a first number of degrees of  
4 freedom;  
5                   the slave has a plurality of actuators operatively coupled to the end effector  
6 so that the end effector can move in a surgical workspace with a second number of  
7 degrees of freedom in response to slave actuator signals, the second number being less  
8 than the first number; and  
9                   the processor generates the slave actuator signals by mapping the input  
10 device in the controller workspace with the end effector in the surgical workspace.
- 1                   4.       The surgical robotic system of claim 3, wherein the linkage of the  
2 master controller has at least one redundant degree of freedom.

1                   5.     The surgical robotic system of claim 3, wherein the slave  
2 comprises a manipulator arm releasably supporting the tool holder, wherein an alternative  
3 tool allows movement of an alternative end effector with at least one more degree of  
4 freedom than the end effector when the alternative tool is mounted to the tool holder,  
5 wherein the processor inhibits movement of the input device in the controller workspace  
6 when the tool is in use so that the input device is movable in the second number of  
7 degrees of freedom.

1                   6.     The surgical robotic system of claim 1, wherein the processor  
2 calculates the transformation in response to a signal indicating at least one member of the  
3 group consisting of a movement of the camera, a decoupling and repositioning of one of  
4 the master and the slave relative to the other, a change in scale of the mapping, manual  
5 movement of a passive joint of the slave, and association of the master with an alternative  
6 slave.

1                   7.     A surgical robotic system comprising:  
2                   a master controller having an input device movable in a controller  
3 workspace;  
4                   a slave comprising a slave arm and a first tool releasably mountable on the  
5 arm, the first tool having a first end effector movable in a surgical workspace in response  
6 to slave actuator signals;  
7                   a second tool releasably mountable on the slave in place of the first tool,  
8 the second tool having a second end effector movable in the surgical workspace in  
9 response to the slave actuator signals, the second tool being kinematically dissimilar to  
10 the first tool; and  
  
11                   a processor coupling the master controller to the slave arm, the processor  
12 generating the slave actuator signals by mapping the input device in the controller  
13 workspace with the end effector of the mounted tool in the surgical workspace.

1                   8.     A surgical robotic system comprising:  
2                   a master controller having an input device movable in a master controller  
3 space, the input device having a grip sensor for squeezing with a hand of a surgeon, the  
4 grip sensor defining a grip pivot;

5                   a slave arm having an end effector supported by a linkage so that the end  
6   effector is movable in a surgical workspace, the slave arm having actuators coupled to the  
7   linkage for moving the end effector in response to slave actuator signals, the end effector  
8   comprising jaws with a jaw pivot;  
9                   an image capture device having a field of view within the surgical  
10   workspace and transmitting an image to a display; and  
11                  a processor coupling the master controller to the slave arm, the processor  
12   generating the slave actuator signals in response to movement of the input device so that  
13   the jaw pivot in the display appears substantially connected with the grip pivot.

1                  9.       The robotic system of claim 8, wherein the end effector rotates  
2   about the jaw pivot when the input device rotates about the grip pivot so that an  
3   orientation of the end effector image shown in the display substantially corresponds to an  
4   orientation of the input device in the controller workspace.